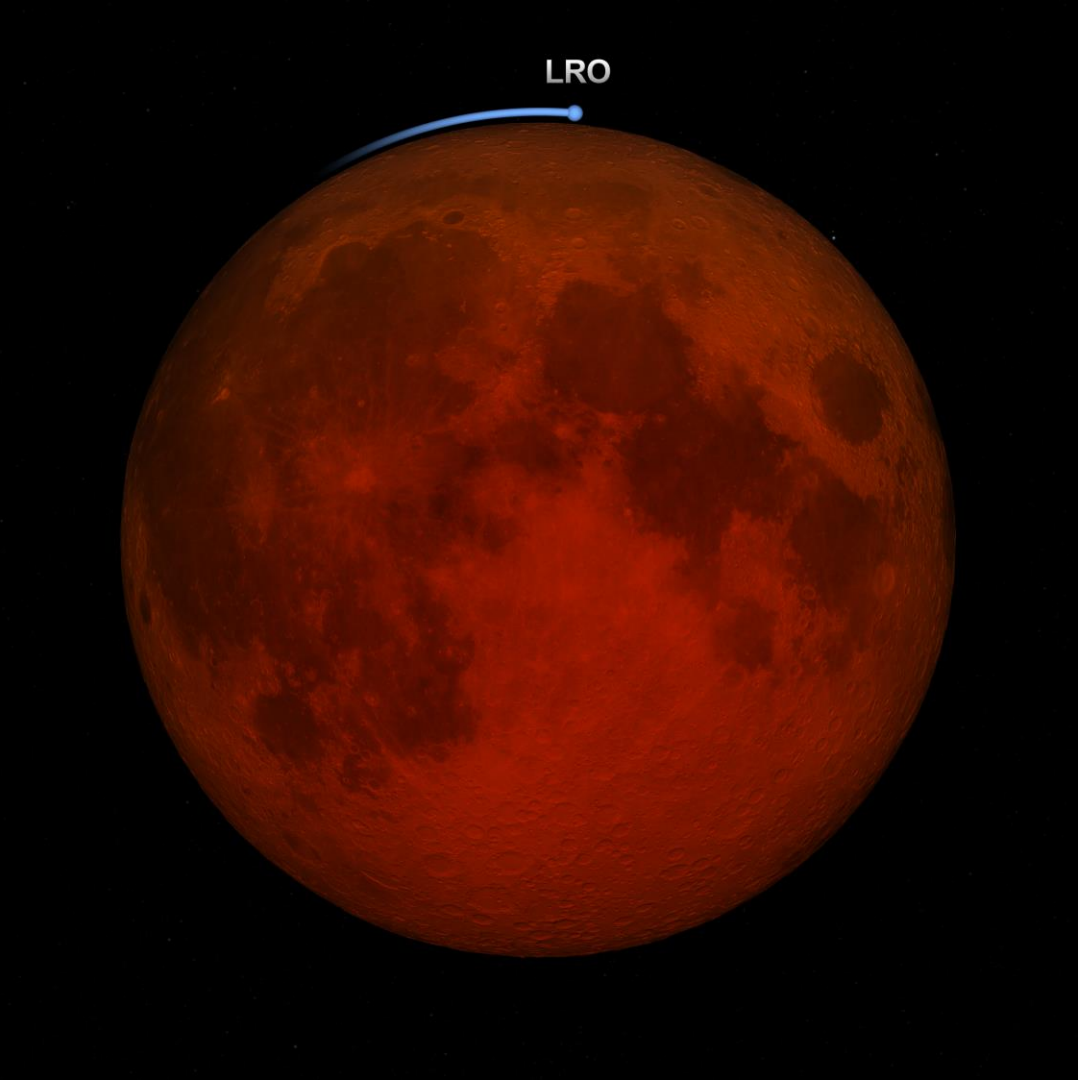


Lunar Eclipse

Study of the irradiance reaching the moon surface during a lunar eclipse

Giuseppe Governale - 347E JPL Affiliate
Robotic Systems Estimation, Decision, And Control

May 9, 2017

Jet Propulsion Laboratory
California Institute of Technology

How does Lunar Eclipse occur?

At least twice a year

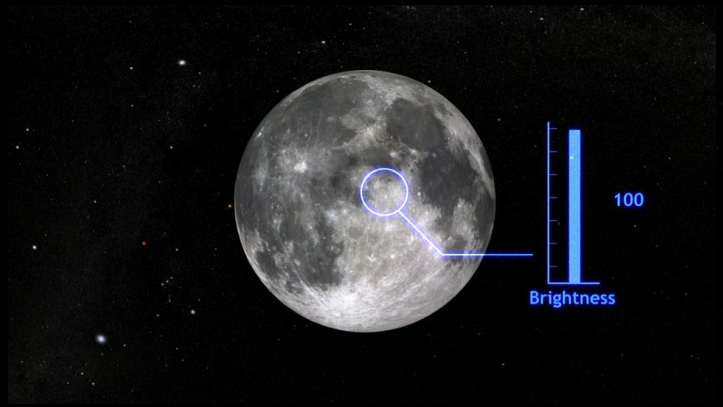
Penumbra

~10% darkening

Umbra

NO direct light

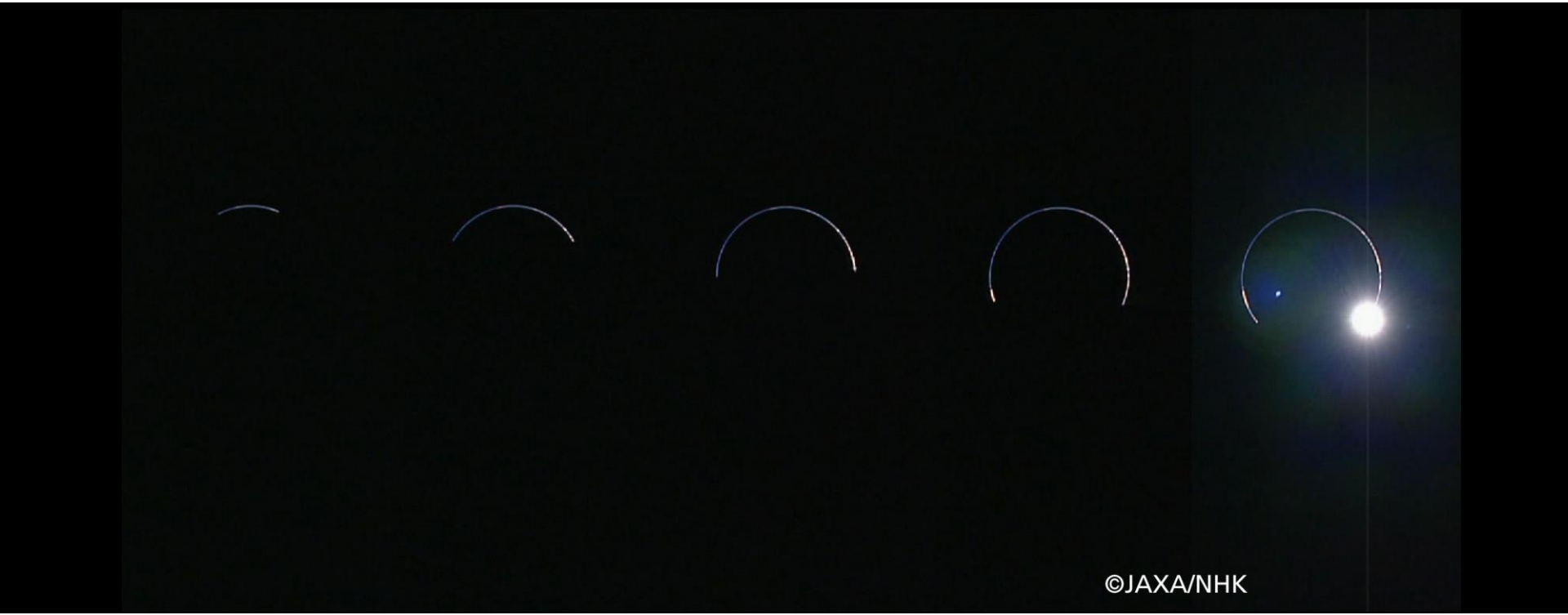
(*Totality* phase)



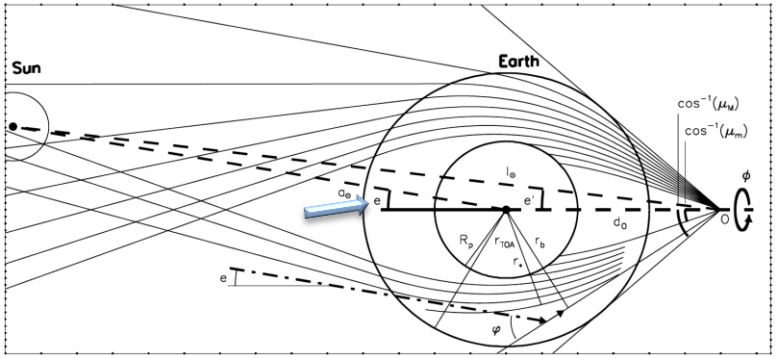
Unusual color of the Moon

An unusual Point of View

Light through the Earth's atmosphere
- short WLs (*blue*) are scattered;
- long WLs (*red*) reach the Moon.

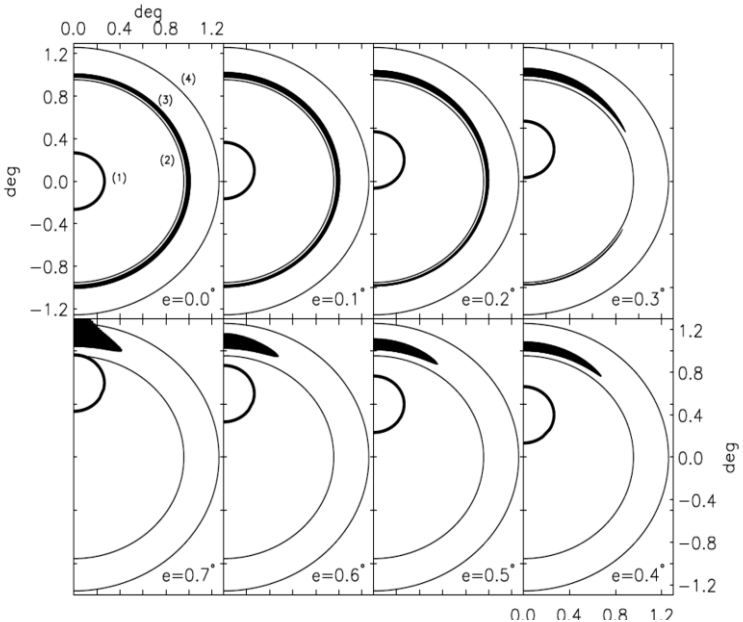


Methodology

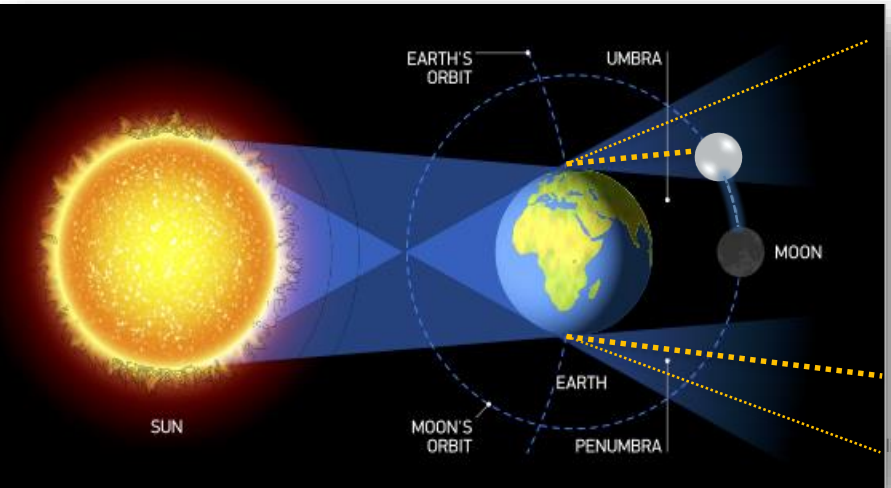


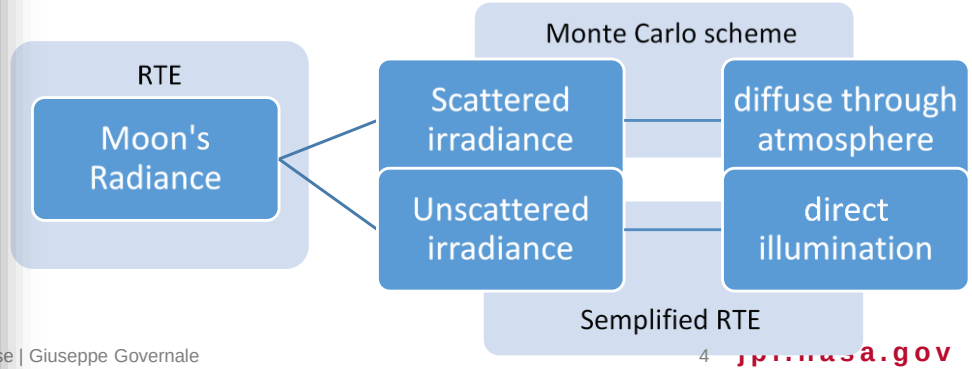
Geometry definition with main parameters (*García Muñoz et al., 2011*)

- Main geometrical parameters defined as the solar elevation angle ***e.***
- Sun image varies as it rises above Earth's limb



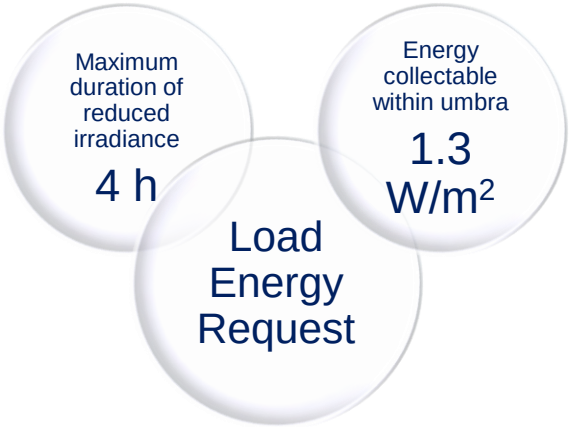
Earth's limb and Sun contour (*García Muñoz et al., 2011*)



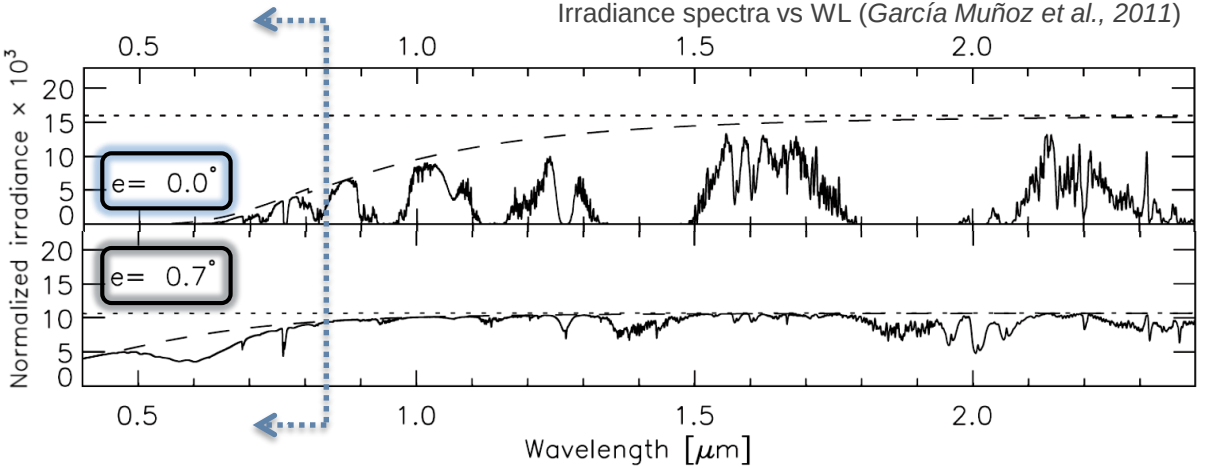


Results

- For small ***e*** (within the umbra), notable irradiance absorbtion***.***
- For WLs shorter than ~850nm, Rayleigh and Oxone absorption.

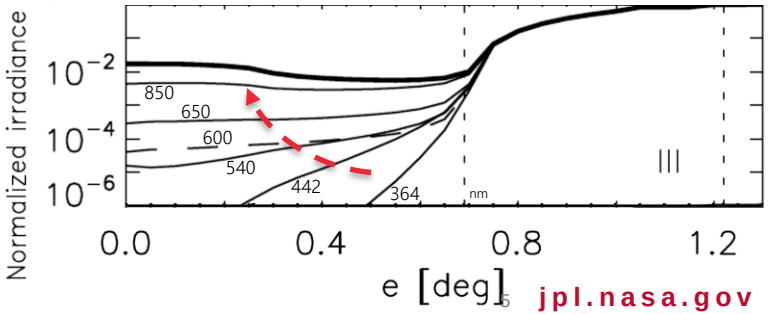


Irradiance spectra vs WL (*García Muñoz et al., 2011*)



First approximation data	
Maximum temperature gradient during a lunar eclipse (obtained by Radio Astronomy)	250K
Maximum Totality duration (entirely within the umbra)	1.7 h
Maximum Eclipse duration (considering data from 2011 through 2030)	4 h
Reduced irradiance in the umbra respect non-eclipse conditions	10^{-3}-10^{-5}

Light curves vs *e* (*García Muñoz et al., 2011*)



Thank you for your attention

Q&A

Jet Propulsion Laboratory
California Institute of Technology

Giuseppe Governale (347E-Affiliate) +1 (626) 864 0713 giuseppe.governale@jpl.nasa.gov giuseppe.governale@studenti.polito.it